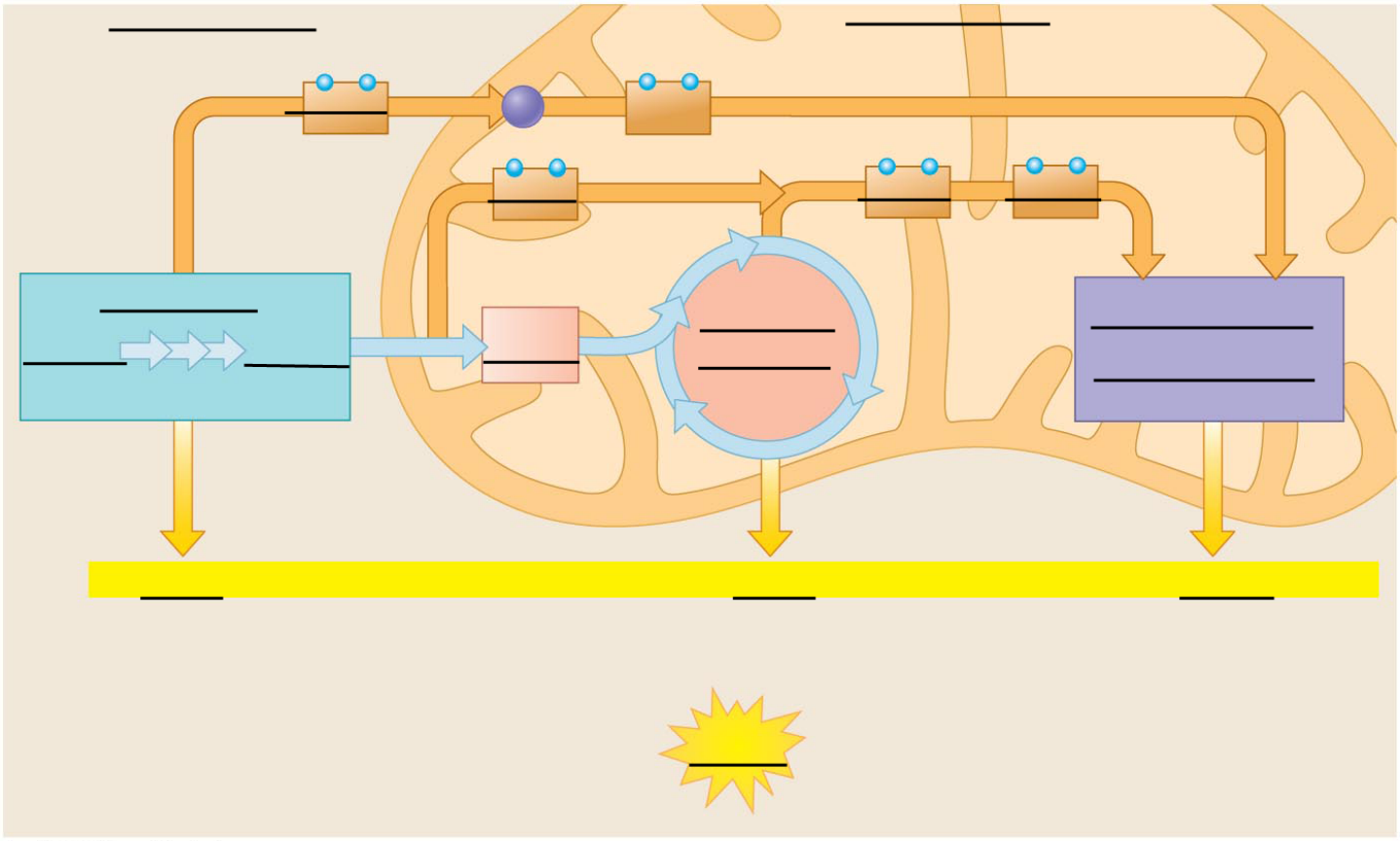
Name_____ Date_____ Period_____

Chapter 6B-How Cells Harvest Energy:
Citric Acid Cycle & Electron Transport Chain

The below figure introduces the 3 stages of cellular respiration. Label the diagram. Include **electron transport chain, pyruvate, mitochondrion, citric acid cycle, glycolysis, cytoplasm, glucose, Acetyl CoA, 2 NADH, 6 NADH, 2 $FADH_2$, 2 ATP, 34 ATP, 38 ATP.** Terms can be used more than once.



Circle the correct words or phrases in parentheses to complete each sentence.

The [1](*final / second)* stage of cellular respiration is the electron transport chain and synthesis of [2](*glucose / ATP*) by a process called the [3](*electron transport chain / active transport*). The electron transport chain is a sequence of [4](*electron / proton*) carriers built into the inner membrane of the mitochondrion. Molecules of $FADH_2$ and [5](*ADP / NADH*) bring high energy electrons to the chain from glycolysis and [6](*the citric acid cycle / electron transport chain*). The electrons move along the chain from carrier to carrier in a series of redox reactions, finally joining with [7](H_2O / CO_2 / O_2). And H^+ from the surrounding solution to form [8](H_2O / CO_2 / O_2). Energy released by the electrons is used to move protons H^+ ions by active transport into the space between the inner and outer mitochondrial membranes.

Check your overall understanding of cellular respiration by matching each of the phrases below with on of the three stages of the process. Use *G* for glycolysis, *CA* for the citric acid cycle, and *ETC* for electron transport chain.

_____9. Generate most of the ATP formed by cellular respiration

_____10. Begins the oxidation of glucose

_____11. Produces four ATPs per glucose molecule, but two ATPs per glucose are used to get it started

_____12. Oxidizes NADH and $FADH_2$, producing NAD^+ and FAD^{2+}

_____13. Here electrons and hydrogen combine with O_2 to form H_2O

_____14. $FADH_2$ and NADH deliver high-energy electrons to this stage

_____15. Reduces NAD^+ and FAD^{2+}, producing NADH and $FADH_2$

16. **Oxidation of pyruvate**
    a. Occurs where?_____
    b. Starts with?_____
    c. Produces?_____
    d. Yields how much ATP directly?_____
    e. Yields how much ATP indirectly?_____
17. **STAGE 2: Kreb cycle/Citric acid cycle**
    a. Occurs where?_____
    b. Starts with?_____
    c. Produces?_____
    d. Yields how much ATP directly?_____
    e. Yields how much ATP indirectly?_____
18. Why do we eat?_____

19. Why do we breath?_____

_____20. The term anaerobic means
A) with O_2.
B) without bacteria.
C) without O_2.
D) without ATP.
E) without CO_2.

_____21. How do cells capture the energy released by cellular respiration?
A) The energy is coupled to oxygen.
B) They produce glucose.
C) They store it as thermal energy.
D) They produce ATP.
E) They store it in molecules of carbon dioxide.

_____22. The overall equation for the cellular respiration of glucose is
A) $C_6H_{12}O_{12} + 3\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ + energy.
B) $C_6H_{12}O_6$ + energy $\rightarrow 6\ CO_2 + 6\ H_2O + 6\ O_2$.
C) $5\ CO_2 + 6\ H_2O \rightarrow C_5H_{12}O_6 + 6\ O_2$ + energy.
D) $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O$ + energy.
E) $C_5H_{12}O_6 + 6\ O_2 \rightarrow 5\ CO_2 + 6\ H_2O$ + energy.

_____23. A kilocalorie is defined as
A) the quantity of food used to maintain normal bodily functions.
B) the quantity of glucose needed to increase the body temperature by 1°C.
C) the quantity of food consumed during a given type of exercise.
D) the quantity of water heat needed to solubilize 1 g of glucose.
E) the quantity of heat needed to raise the temperature of 1 kg of water by 1°C.

_____24. During cellular respiration, the energy in glucose
A) can be used to oxidize NADH.
B) becomes stored in molecules of ammonia.
C) is released all at once.
D) is carried by electrons.
E) is used to manufacture glucose.

_____25. Oxidation is the _____, and reduction is the _____.
A) gain of electrons . . . loss of electrons
B) loss of oxygen . . . gain of oxygen
C) loss of electrons . . . gain of electrons
D) gain of protons . . . loss of protons
E) gain of oxygen . . . loss of oxygen

_____26. During cellular respiration, NADH
A) is chemically converted into ATP.
B) delivers its electron load to the first electron carrier molecule.
C) is the final electron acceptor.
D) is converted to NAD^+ by an enzyme called dehydrogenase.
E) is reduced to form NAD^+.

_____27. Which of the following options lists the stages in cellular respiration in the correct order?
A) the citric acid cycle, electron transport chain, and glycolysis
B) electron transport chain, the citric acid cycle, and glycolysis
C) glycolysis, electron transport chain, and the citric acid cycle
D) glycolysis, the citric acid cycle, and electron transport chain
E) electron transport chain, glycolysis, and the citric acid cycle

_____28. Which of the following metabolic pathways is common in aerobic and anaerobic metabolism?
A) the citric acid cycle
B) electron transport chain
C) glycolysis
D) oxidative phosphorylation
E) chemiosmosis

_____29. As a result of glycolysis there is a net gain of _____ ATPs.
A) 2
B) 4
C) 36
D) 0
E) 1

_____30. Which of the following is a result of glycolysis?
A) production of CO_2
B) conversion of FAD to $FADH_2$
C) conversion of NADH to NAD^+
D) a net loss of two ATPs per glucose molecule
E) conversion of glucose to two three–carbon compounds

_____31. At the end of the citric acid cycle, most of the energy remaining from the original glucose is stored in
A) pyruvate.
B) CO_2.
C) ATP.
D) NADH.
E) $FADH_2$.

_____32. By–products of cellular respiration include
A) oxygen and heat.
B) $FADH_2$ and NADH.
C) carbon dioxide and water.
D) NADH and ATP.
E) carbon dioxide and ATP.

_____33. Each $FADH_2$ yields a maximum of _____ ATP, and each NADH yields a maximum of _____ ATP as a result of transferring pairs of electrons to the electron transport chain.
A) 3 . . . 2
B) 2 . . . 3
C) 1 . . . 3
D) 3 . . . 1
E) 3 . . . 3

_____34. Which of the following processes produces the most ATP per molecule of glucose oxidized?
A) alcoholic fermentation
B) aerobic respiration
C) All produce approximately the same amount of ATP per molecule of glucose.
D) anaerobic respiration
E) lactic acid fermentation

_____35. The main function of cellular respiration is
A) breaking down toxic molecules
B) making ATP that powers cell activities
C) making
D) producing chemical "building blocks" for cell structures
E) breaking down ATP, so that ADP and P can be reused

_____36. The ultimate source of the energy powers our cell is
A) glucose
B) fermentation
C) oxygen
D) biosynthesis
E) the sun

_____37. In cellular respiration, _____ is oxidized and _____ is reduced.
A) O_2 . . . ATP
B) ATP . . . O_2
C) glucose . . . O_2
D) CO_2 . . . H_2O
E) glucose . . . ATP

_____38. Which of the following describes glycolysis?
A) It begins the oxidation of glucose
B) It produces a small amount of ATP
C) It generates NADH
D) It splits glucose to form two molecules of pyruvate
E) All of the above

_____39. Most of the NADH that delivers high-energy electrons to the electron transport chain come from
A) chemiosmosis
B) the cytoplasm
C) glycolysis
D) biosynthesis
E) the citric acid cycle